SCIENCE

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INTRODUCTION OF THE ARTICULATING SYSTEM FOR THE DEAF IN AMERICA.[1]

WE are gathered to-day to celebrate the twenty-first anniversary of the opening of the Horace Mann School and the dedication of this building to its use. The many friends that surround us, the band of experienced teachers, the large number of pupils, this new and beautiful building, mark it as the day of our prosperity.

It seems fitting on this occasion to spend a few moments in recounting the causes that led to the establishment of this school, in showing what it has accomplished for the education of the deaf at home and abroad, and in recalling the memory of him through whose instrumentality it was founded.

This was the first public day-school ever opened to deaf children. Before this, they had been gathered into institutions apart from friends, isolated from the world around them, a distinct and separate community. This plan was thought necessary to their education. Our experiment, carried on for twenty-one years, has proved, by its continued and growing success, that to the deaf as well as to others all the advantages of school education can be extended without the severance of home and family ties. As the direct offspring of this the first day-school, similar schools have grown up in other States, and its influence is felt through the length and breadth of our land.

Have we not reason to be glad of the past, and take courage for the future? But this school represents not merely the opening of the first day-school, but, with the Clarke Institution, the introduction and development of a system of education for the deaf until then unknown in this country. Before that time the education of the deaf had been carried on by the sign-language. That this system had accomplished great and good results we gratefully acknowledge; but in our midst was growing up a distinct race, using a language of their own, unknown to their friends, without literature, and, though perhaps often beautiful and expressive, still vague and indefinite.

Perhaps but few who rejoice with us to-day can go back in memory to the time when, in doubt and anxiety, but with courage and hope, our little school was opened, and still further back to the introduction into this country of the oral system of deaf-mute education which this school has helped to develop.

Let us briefly review the history of deaf-mute education in this country from its commencement; and, if my narrative becomes somewhat personal, may I be excused. All great movements start from a small centre. Our broadest charities have grown from some individual human need. My own interest in the education of the deaf, and my earnest efforts to introduce what I believed a better method of instruction than the one then in use, sprang first from my anxiety for my little deaf child.

Early in the present century the parents and friends of a little deaf girl in Hartford, Conn., sought for her some means of education. There were no schools for the deaf in this country, and the Rev. Thomas Gallaudet was sent abroad to visit the various institutions in France and Germany, and study the methods of instruction. He brought back the French system of the Abbe de l'Epée. On inquiry, a number of deaf children were found, and the American Asylum at Hartford was incorporated. An appropriation was obtained from Congress and from each State from which pupils were sent. Other schools were opened in different States from time to time, and in all the sign-language was used.

Vague reports were occasionally brought to this country of another system, used in Germany, where the deaf were taught to speak and read from the lips. Nothing definite was known in regard to this system until 1843. In that year Mr. Horace Mann, then secretary of the Board of Education from Massachusetts, and Dr. Howe, went to Europe to study the various systems of education. They visited several schools for the deaf in Germany, and were surprised to find deaf children taught to speak and read from the lips. On their return, Mr. Mann published a report, and strongly advocated the adoption of the German oral system of instruction in this country.

His report excited such general interest, that the American Asylum and the New York Institution sent gentlemen abroad to investigate the subject. They reported that the sign-language was used in France, Italy, and Great Britain, and the oral system in Germany only; "that in the case of the great majority, instruction in mechanical articulation was attended by too little benefit to compensate for the serious efforts made in attempting it," and therefore no material change should be made in the American schools. A teacher of articulation was employed for a short time at the American Asylum; but the results were not satisfactory, and the system was abandoned. Earnest and devoted teachers labored faithfully to develop the mind and train the faculties through the medium of the sign-language. Much was accomplished, many a darkened mind was brightened, many lives enriched, many a saddened heart made glad; but the child was a foreigner in its own land, comprehending and using a language known only to the institution. It was taught to read and write the English language, but it remained always an unfamiliar tongue. The medium of instruction met the natural expression of its thoughts and feelings.

In 1860 my little girl lost her hearing through a fearful illness. She was a bright, intelligent child of four years, but her language was lisping and imperfect. When convinced of her deafness, our great anxiety was to retain her

[1] Address delivered by the Hon. Gardiner G. Hubbard at the twenty-first anniversary of the Horace Mann School, Boston, Mass.

language, and to know how we might carry on her education. We asked advice of one of the oldest teachers of the deaf. "You can do nothing," was the answer. "When she is ten years old, send her to the Institution, where she will be taught the sign-language."

"But she still speaks. Can we not retain her language?"

"She will lose it in three months, and become dumb as well as deaf. You cannot retain it."

It was in this time of our discouragement that we heard of the visit of Mr. Horace Mann and Dr. Howe to the schools of Germany, and their report in favor of the oral system. We turned to Dr. Howe for help. He told us that even children born deaf could be taught to speak, and encouraged us to talk to our little girl, and to teach her to recognize the spoken words of our lips. He warned us not to use nor to allow any signs, and never to understand them. Cheered by his encouragement, but discouraged by all other teachers of the deaf and by our own ignorance, we groped our way. Gradually light dawned. The child began to recall words forgotten in her long illness, and to add new words to her vocabulary learned from our lips. A young teacher, Miss True, who has ever since been devoted to the instruction of the deaf, but was then totally inexperienced, though admirably fitted by nature and training for the work, came to our aid. Our little girl joined her sisters in their lessons and their play. She knew no signs, she spoke imperfectly but intelligibly, and understood those around her. It was in after years that she told me she did not then know that she differed in any way from other children, and sometimes wondered why strangers would address her younger sister rather than herself. Meanwhile, under Miss True's intelligent teaching, her mental development progressed rapidly, and her language grew daily. We could not but feel that we had chosen the better system of education for our child, and earnestly wished other deaf children might share its advantages. We were confirmed in this opinion when, on a trip to Washington, we called with our little girl on Mr. Gallaudet and his mother, a deaf-mute. As she observed the child, and witnessed the readiness with which she understood and answered Mr. Gallaudet, she turned to her son and asked, "Why was not I taught to speak?"

In 1864, in connection with a few friends and aided by Dr. Howe, we applied to the Legislature for a charter for a school where the system of teaching articulation and lip-reading should be used. Hon. Lewis J. Dudley of Northampton, a member of the Senate and of the Committee on Education to which our petition was referred, had a daughter born deaf, then a pupil in the American Asylum. He was convinced from his own observation that it was impossible to teach the deaf to speak, and through his influence our efforts were defeated.

Not baffled nor discouraged by defeat, we then, with the aid and sympathy of a few friends, determined to open a little school of our own. After eight months of waiting for pupils, our school was opened at Chelmsford, in June, 1866, with only five pupils; but Miss Rogers was their teacher. Her sister had been with Dr. Howe as the teacher of Laura Bridgman and Oliver Caswell, both deaf, dumb, and blind from their birth. How identified Miss Rogers has been with the whole work from the very beginning, how much of its success is due to her earnestness and entire devotion, we all know.

Since the first days of that little school, teachers equally faithful, equally devoted, equally earnest, have entered into the work, and have carried it on to its present success; but Miss Rogers gave it its first start. Hon. Thomas Talbot, then lieutenant-governor, and brother-in-law of Miss Rogers, became interested in the work, and encouraged us to apply again to the Legislature. Mr. Talbot called with me on Gov. Bullock to secure his aid. To our great surprise and pleasure, the governor informed us that he had just learned that a gentleman in Northampton had been watching our work, and was ready to give fifty thousand dollars towards the endowment of a school for the deaf in Massachusetts, and that he would gladly help us.

In his annual address to the Legislature, in 1867, he said, "For successive years the deaf-mutes of the Commonwealth, through annual appropriations, have been placed for instruction and training in the asylum at Hartford. While, in the treatment of these unfortunates, science was at fault and methods were crude, in the absence of local provisions, this course was perhaps justifiable; but with added light of study and experience, which has explored the hidden ways and developed the mysterious laws by which the recesses of nature are reached, I cannot longer concur in the policy of expatriation, for I confess I share the sympathetic yearnings of the people of Massachusetts towards these children of the State detained by indissoluble chains in the domain of silence. This rigid grasp we may never relax; but over unseen waves, through the seemingly impassable gulf that separates them from their fellows, we may impart no small amount of abstract knowledge and moral culture. They are the wards of the State. Then, as ours is the responsibility, be ours also the grateful labor; and I know not to what supervision we may more safely intrust the delicate and intricate task than to the matured experience which has overcome the greater difficulty of blindness superadded to privation of speech and hearing. In no other object of philanthropy the warm heart of Massachusetts responds more promptly, assured as I am, on substantial grounds, that legislative action in this direction will develop rich sources of private beneficence. I have the honor to recommend that the initial steps be taken to provide for this class of dependants within our own Commonwealth," etc.

This portion of the message was referred to a large joint special committee, of which Mr. Dudley was chairman on the part of the House. Dr. Howe and Mr. F. B. Sanborn (the chairman and secretary of the Board of State Charities) appeared for that board; I represented petitioners for an act of incorporation; while Rev. Collins Stone (the principal of the American Asylum), Rev. W. W. Turner (its former principal), and Hon. Calvin Day (one of its vice-presidents) appeared in the interests of the asylum as advocates of the sign-language, and as opponents of our petition. A large number of deaf-mutes, with Professor D. E. Bartlett as interpreter, were also present. At one of the hearings my daughter was called before the committee, and questioned in arithmetic, history, and geography. Her answers were satisfactory.

To test her general intelligence, a gentleman asked, "Can you tell me who laid the first Atlantic cable?" Quickly and smilingly she answered, "Cyrus Field." The committee was convinced that her progress and intelligence were equal to that of most hearing children of the same age, and gave us our charter. At one of these hearings our little girl saw for the first time the deaf-mute's signs, and asked why deaf-mutes did not speak with the lips, as she did, for she thought it a great deal better to talk with the mouth than with the fingers.

Mr. Dudley became convinced of the superiority of the

oral system, and, with tears in his eyes, asked if his little daughter could ever be taught to speak. In a year he heard from her lips the words "father" and "mother."

Miss Rogers removed with her little school to Northampton, and became its principal. Thus the first school for teaching articulation, lip-reading, and oral instruction, was established in this country.

A member of the committee from Boston, also a member of the school committee of Boston, took an especial interest in the hearing. He attended every meeting, and visited our little school at Chelmsford, called repeatedly to see our daughter, and aided us by every means in his power to obtain our charter, having first inserted a provision giving us the right to establish schools in two other suitable places besides Northampton. The name of that gentleman was Dexter S. King. His interest in the education of deaf children, instead of ceasing with the granting of our charter, increased.

Scarcely was our school opened, when he asked that a branch might be started in Boston. This we were unable to do. Mr. King, as a member of the school board, secured the appointment of a committee to consider this subject in 1868 and 1879. The city was canvassed. Fifty deaf children were found, of whom only twenty-two were in school. Twenty-eight were at home, with no one able to render them aid in their search for an education. The committee established this school by the name of "The School for Deaf-Mutes." It was on Nov. 10, 1869, in a room in the old schoolhouse in East Street, with nine pupils. In one week an afternoon session had opened for eleven other pupils in the schoolhouse on Somerset Street. In January, 1870, it moved into suitable quarters on Pemberton Square, where it remained for several years.

When Mr. King retired from the school committee of the city of Boston, in 1871, a series of resolutions were passed,—"that to him was mainly due the project of establishing in this city a public school for deaf-mutes, the first institution of the kind in America,"—and expressing the thanks of the board for his valuable services.

For the remaining years of his life he was almost a daily visitor at the school. In the year 1873 the name of the school was changed to "The Horace Mann School." A principal was necessary who could not only instruct the deaf, but could supervise all the interests of the school, securing both the affection of the pupils and the confidence and respect of the school committee. To Miss Fuller this school and the deaf children of America owe a debt of gratitude that can never be repaid.

A few years later an English gentleman, Mr. B. St. John Ackers, visited the various schools of England and America, seeking for the best means of educating his own deaf child. He decided that she should be taught by articulation rather than by signs, which was the system then used in the English institution. He was so much pleased with this school, that he engaged one of its teachers, Miss Barton, to return with him. More and more convinced of the superiority of articulation teaching, and feeling the importance of thorough and earnest teachers, he was led to establish a normal school, which has sent out many teachers well fitted for their work. Subsequently Mr. Ackers, then a member of Parliament, was influential in securing the appointment of a royal commission to investigate and report upon the condition of the blind, the deaf, and the dumb of the United Kingdom, and was appointed one of the commission by the Queen.

Mr. Gallaudet and Professor Bell were invited to be present as representing the two systems in use in this country. Mr. Bell gave a full account of the Horace Mann School and its work, in which he has always felt the deepest interest. In their report the commission recommend "that every child who is deaf should have full opportunity of education in the oral system; that all children should be for the first year, at least, instructed in the oral system; and after the first year they should be taught to speak and lip-read on the oral system, unless they are physically deficient; that children who have partial hearing should in all cases be instructed in the pure oral system; that trained teachers of the deaf should, as in Germany, receive salaries such as would induce teachers of special attainments to enter the profession, and on a higher scale than those enjoyed by trained teachers of ordinary children."

In England as well as in our own country the influence of our work has been felt. The year before the Clarke Institution was opened, there were only 119 deaf children from the State at school. Now there are 312, an increase of 160 per cent, while our population has increased only 50 per cent.

Massachusetts has, therefore, more than three times as many pupils to-day in proportion to population as it had twenty years ago. Starting from Massachusetts as a centre, public interest was everywhere excited by the deaf. New institutions and day-schools were established in different parts of the country. In many of these the oral system alone was used. In all, teachers of articulation were employed, and articulation and lip reading made a part of their daily instruction. The number of pupils has increased from 3,246 in 1870, to 8,575 in 1890; and, in proportion to population, the ratio of increase equals that of our own State three to one. Who can doubt but that this is due to the influence of the Clarke and Horace Mann Schools, and to the general interest they have awakened in the education of the deaf?

Institutions for the deaf are undoubtedly necessary in every State, as children must be gathered from distant points; but wherever there are, in cities, a sufficient number of children, day-schools are certainly to be preferred. The home influence, the strong ties of affection, are often more important to the deaf child than to the hearing, for he is less prepared to fight the battle of life. The success of the Horace Mann School has led to the opening of day-schools in Portland, Providence, Cincinnati, Milwaukee, Chicago, St. Louis, Evansville, New Orleans, and La Crosse.

Let us here pause for a moment to pay a tribute of respect to the memory of one of the first and best teachers of this school. Early in its history Miss Bond became interested in it, and gave to it her time, her sympathies, and her earnest labors. For years her efforts for its progress were unwearied, and even in failing health and extreme physical suffering the welfare of the school was ever in her mind.

When we consider that the interest in deaf-mute education which formed the Royal Commission and the recommendations which have so changed the system of education in Great Britain is a direct growth from our work, have we not reason to believe that the seed sown in our weakness has already borne much fruit, and will yield a still more abundant harvest?

Believing that for the deaf our system lessens their privations, brings them more into communication with their friends and fellows, and, instead of building up still higher the separating wall of a different language, opens to them as to others the treasures of written language, shall we not rejoice that

it has been our privilege to work together for this end, and that out of the affliction of a little child a blessing has come to so many ?

The success of our schools in which we rejoice to-day is due not only to the superiority of the oral system over the sign-language system, not only to the energy and perseverance of their founders, but, more than all, to the devotion, to the untiring zeal, and to the ability, of our teachers. No other teaching is so exacting, requires such constant attention and unwearied application.

The names of all are too numerous to mention. In our earthly as in our heavenly firmanent one star differeth from another in glory, but bright as constellations shine the names of Miss Rogers, Miss Fuller, and Miss Bond.

This school is appropriately named the Horace Mann School, since Mr. Mann was the first to recommend the adoption of the oral system; but it was to Mr. King that this school owes its existence. The names of those who laid the foundation and built the edifice should not be forgotten.

But it is to Mr. King that this school owes its existence. A bronze tablet should be affixed to its walls; and associated with the name of Horace Mann should be the names of Dexter S. King and Sarah Fuller, inscribed thereon, that thus the names of the three who have done so much for the education of the deaf may be perpetuated.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.[1]

AN institution of learning may make a demand upon public recognition and gratitude because of its good work in training successive classes of young men for usefulness in life, even though it be not an innovator in education, and uses only the old and familiar methods of instruction; but it may acquire a further and larger claim by becoming a leader in its department, by introducing new methods, and opening the way to a better kind of intellectual and professional training.

How the Institute of Technology has dealt with the thousands of young men who have been its pupils since 1865, what it has done for them, what places they now occupy in the industrial system, what services they have rendered to the arts and industries of the country, common fame will tell. Those who would study this matter more carefully will find material in the lists of its graduates and of the places they fill, as told in the annual catalogues.

But in addition to its work in training a certain number of young men for the duties of life, the Institute of Technology has been pre-eminently a leader in education. Its influence has not been confined to what it has done for its own pupils, but has extended as far as its example of advanced scientific and technical instruction has gone.

Almost at the very outset a long step forward was taken in the establishment of a laboratory of general chemistry. Up to that time general chemistry had been taught wholly by means of text-books, or by lectures with experiments by the lecturer. The student's part was only to look and to listen, and learn in this way what he could. It was not until the student was put into the analytical laboratory, and took the retort into his own hand, that he did or discovered any thing for himself. Under the inspiration of Professor Rogers and the enterprise and administrative skill of Professor Charles W. Eliot and Professor Frank H. Storer, a laboratory of general chemistry was established, and the pupil from the first day of his chemical studies was set to teach himself. This was no analytical laboratory. It was simply designed as a means of illustrating, emphasizing, and supplementing the instruction of the lecture-room in regard to the nature of chemical action and the characteristics of the principal elements. The student was not told what he should find. He was told to do something, and note what occurred. He was thrown upon his own faculties of observation and reflection. He learned to know himself, and to measure his own power, and he acquired ease and accuracy of manipulation by practice. So far as known, this was the first laboratory of such a character set up in the world. Certainly it was the first one instituted in the United States for the instruction of considerable classes of pupils. The publication of "Eliot and Storer's Manual," designed for students taking this course, marked an epoch in the history of education.

Another equally important step in scientific education, and one of which the originality is beyond doubt, was taken at about this time in the establishment of a laboratory now known as the Rogers Laboratory of Physics. Under the inspiration of President Rogers, the scheme of a laboratory where the student of physics should be set to make observations and conduct measurements for himself, in demonstration and illustration of the physical laws taught in the lecture-room, was carried out with remarkable ability on both the scientific and administrative sides by Professor Edward C. Pickering, now director of the Harvard Observatory. So complete was Professor Pickering's study of the needs and capabilities of such a laboratory, so masterly his treatment of it, that it has required only more room and additional apparatus to allow the system he then devised and formulated to be extended successively to classes of fifty, of one hundred, and even of one hundred and fifty students.

In the school year of 1871–72 another forward step in education was taken at the Institute of Technology. Down to that time the instruction in mining engineering and metallurgy had been, here as elsewhere, conducted by means of text-books, lectures, drawing models, and assays of small pinches of ore, supplemented, in the case of the more fortunately situated schools, by occasional visits to mines in actual operation. In the year named a scientific expedition to the Rocky Mountains was undertaken by a large party of students and instructors from the institute. While in the Colorado mining regions, Professor Runkle conceived the idea of a laboratory which should add to the existing means of instruction in mining and metallurgy the practical treatment by the students of economic quantities of ores. This conception, so fully in the line of the general work of the institute, was given effect by the purchase in California, before the return of the expedition, of a number of pieces of apparatus suitable for the beginnings of such a laboratory. The apparatus thus obtained was set up by Mr. Robert H. Richards, then instructor, and now for many years professor, of mining engineering.

From these small beginnings made under Professor Richards's care it has grown steadily to this day. It was the first proper metallurgical laboratory devoted to the purposes of instruction in the world. It is under its title, "The John Cummings Laboratory," by far the largest and the best in the world to-day. Its graduates are found in the most important mines and smelting and reduction works of the

[1] From the Commemorative Address by Augustus Lowell, Esq., at the twenty-fifth anniversary of the Massachusetts Institute of Technology.

United States, showing the effect of their training at the institute, in which theory and practice were so happily combined, and in which every thing taught in the lecture-room is at once put to use in experiment and research.

In 1873 a further step in technical education led to the establishing of a laboratory of steam-engineering. An engine of sixteen horse-power was set up, and the necessary apparatus for engine and boiler tests was provided. Out of this humble beginning has grown the largest and best equipped mechanical engineering laboratory to be found, in which not only is the work of instruction carried further than ever before, but original research, conducted jointly by the students and their instructors, is pushed to points often beyond the range of ordinary expert investigation within the profession. In the same year the Lowell Free School of Industrial Design was established at the expense of the Lowell Institute, for the purpose of promoting the industries of the country, and especially the textile manufactures, by cultivating the American taste in respect to form and color.

In 1876 the system of shop-work as a means both of general and professional training was introduced. Half an acre of shops, filled with the best tools, machines, and engines, with over two hundred students pursuing this branch of instruction, represent to-day the poor, mean shed, with its scanty appliances, which was all that the funds at the command of the institute allowed to be erected in 1876.

In 1881 was established a laboratory of applied mechanics, devoted especially to the tests of building-materials in wood, stone, and iron. The equipment of the laboratory has been increased from year to year, until it comprises a great variety of apparatus and machines, designed largely by the instructors in that department, for making almost every kind of test which the purposes of the engineer, the architect, the ship-builder, or the mill-owner may require, — beam tests, column tests, belting tests, rope and wire tests, shafting tests, tests by tension, by transverse strain, by compression, by tensile strain, and continuous, intermittent, or instantaneous tests.

In 1884 the germ of a biological laboratory, which had existed in a corner of the shed used for the workshops of 1876, was developed with the aid of a large amount of physiological apparatus. The resources of the laboratory were turned, first, upon the preparation of its students for subsequent medical studies, and, secondly, upon bacteriological investigations, to which the marvellous discovery of Koch and Pasteur had pointed. It is not too much to say that there is scarcely a place in this country where as much important bacteriological work has been done during the past three years as in this laboratory of the institute.

In 1882 the increased demands upon the department of physics for the higher and more technical instruction of students, looking forward to electrical practice, led to the establishment of a distinct service devoted exclusively to that end, and, in connection with the new building of 1883, to the equipment of an electrical laboratory, with engine, dynamos, electric motors, and a great variety of electric testing apparatus. Notwithstanding this equipment, this course in electrical engineering, as it has been developed at the institute, could not be sustained but for the machinery and ample appliances of the engineering laboratories. The training of the electrical engineer at the Institute of Technology differs from that usually followed, in that the electrical engineer is here regarded as primarily a mechanical engineer, but a mechanical engineer who has specially studied the mechanical requirements of the electrical industries and enterprises, just as the chemical engineer under the course established two years ago is regarded in his relation to the chemical industries. And this introduces us to the last contribution made by the Institute of Technology to the philosophy of scientific and technical education, in the recognition of laboratory work in mechanics as an essential feature of a proper training in any branch of the great engineering profession. In the mechanical laboratories the students in each branch of engineering, civil, mechanical, mining, electrical, chemical, and sanitary, are called to perform the work of experiment, and to deal with the generation of power, and its application to the exigencies of their several contemplated professions.

We have thus roughly traced the history of the Institute of Technology. We have seen within how few years it has grown from a doubtful experiment into one of the most important schools of the country. We have seen how largely it has enjoyed the confidence and liberality of the public, and we feel that we may securely rely upon the same generous support hereafter. We have seen how its methods of instruction have been adapted to the changes and developments of practical science. We have seen that in this mobility, this power of adaptation, lay the grand idea of the whole scheme; and we are sure, that, so long as it continues to be its guiding principle, the Institute of Technology will stand, — a monument to the character, learning, and wisdom of its founder, worthy the community in which its establishment was possible and by which it has been maintained, an honor to the instructors who have devoted their energies to its service, and fortunate, as we trust it may long be, under the direction of so distinguished and able a president as Gen. Francis A. Walker.

HEALTH MATTERS.

The Influenza in Massachusetts.

THE secretary of the State Board of Health closes his annual report with the following facts about last winter's epidemic: "1. The first appearance of the influenza in Massachusetts as an epidemic, in the past season, may be stated to have been on Dec. 19 or 20, 1889, and the place of its first appearance was Boston and its immediate neighborhood. 2. It increased rapidly in the number of persons attacked, and reached its crisis generally throughout the State in the week ending Jan. 11, 1890, after which date it gradually declined in severity, and had nearly ceased as an epidemic by Feb. 10, so that the duration of the epidemic was about seven weeks. It reached its crisis earlier by several days in Boston than in the smaller cities and the remoter parts of the State. Its course was still later in Nantucket, Dukes, and Barnstable Counties. 3. The ratio of the population attacked was about forty per cent, or more exactly, as indicated by the returns, thirty-nine per cent, or about eight hundred and fifty thousand persons of all ages. 4. People of all ages were attacked, but the ratio of adults was greatest, of old people next, and of children and infants least. 5. The weight of testimony appears to favor the statement that persons of the male sex were attacked in greater number and with greater severity than females. 6. The average duration of the attack (acute stage) was from three to five days. 7. The predominant symptoms were mainly of three general groups, — nervous, catarrhal, and enteric, — the last being much less common than the others; the special symptoms much observed in the nervous group being extreme depression, pain, and weakness; in the catarrhal group, cough, dyspnœa, and coryza; and in the enteric group, nausea, vomiting, and diarrhœa. 8. The chief diseases which followed in the train of influenza, and were intimately associated with it, were bronchitis and pneumonia. Phthisis, when already existing in the victim of the attack, was undoubtedly aggravated, and in many cases a fatal termination was hastened. 9. The

ratio of persons attacked in industrial and other establishments employing large numbers was about thirty-five and a half per cent, or less than that of the population at large. That of the inmates of public institutions was still less,— twenty nine per cent. 10. The ratio of persons who were obliged to leave their work on account of illness from influenza was about twenty-seven per cent of the whole number employed. 11. The average length of their absence from work was five days. 12 Special occupations do not appear to have had a marked effect in modifying the severity of the epidemic upon operatives in such occupations. While the atmosphere may constitute one important medium of its communication, human intercourse also suggests itself as an equally important factor."

Fasting.

In connection with Professor Moleschott of Rome, Professor Luciani of Florence made a careful study of the "Hunger Virtuoso," Signor Succi, during his thirty-days' fast some two years ago. The results of their work are published in a monograph entitled "Fasting: Studies and Experiments upon Man," printed in Italian and German.

According to the *Medical Record*, Signor Succi, when not starved, is a man of strong muscular frame, with little subcutaneous fat, and weighing about one hundred and forty-seven pounds. During his thirty-days' fast in Italy he lost 6,161 grams, or about thirteen pounds During his first thirty days of fasting here he has lost considerably more. He drank at that time an average of 577.5 grams of water daily, which is about the amount he takes now.

Luciani states that he had "firm muscles, a good deposit of subcutaneous fat, a very slow tissue-change, and, above all, an extraordinary force of will." The Italian professor seems to think that by voluntary exertion Succi is able to slow down the metabolic processes, just as some peculiarly endowed persons can slow down the heart. It is upon this interesting point that Luciani particularly dwells; and he finds in Signor Succi a proof of the regulating influence of the nervous system over the functions of heat-production, respiration, hepatic action, etc.

How the Pathogenic Bacteria do their Harm.

Brieger and Fränkel have studied this question. Of course, the first condition for successful inquiry was to employ pure cultivations of the organism experimented upon. Basic bodies, denominated "toxine," had already been found in several pathogenic micro organisms, such as the bacillus of typhoid, tetanus, cholera, etc.; yet it was found that this toxine did not invariably call forth all the phenomena of the infectious diseases due to the bacilli, from pure cultivations of which it had been obtained: the supposition, therefore, seemed fair, that, besides the already found chemical bodies, there were other substances which played a momentous part (*The Edinburgh Medical Journal*). Brieger and Fränkel considered that Löffler's bacillus of diphtheria was well adapted for their purpose, because it is now beyond doubt that this organism is the genuine cause of diphtheria. Löffler had already called attention to the fact that this bacillus, when inoculated on animals, — guinea-pigs and pigeons, — colonized only the immediate neighborhood of the infected spot; yet grave alterations of texture and organs, and speedy death, of the animals experimented on, followed. This connection of events could only be explained in this way,— that the bacilli produced, by their local multiplication, a substance of exceedingly poisonous properties, which spread over the whole organism, and, independently of the bacteria did its deadly work. Brieger and Fränkel consider that they have proved that Löffler's diphtheria bacillus engenders in its pure cultivation a poisonous, soluble substance separable from the bacteria, which, when injected into susceptible animals, calls forth the same phenomena as the injection of the living micro-organism. The authors also have settled that this substance is destroyed by a heat of 140° F.; that it can stand a heat of 122° F., even in presence of excess of muriatic acid. This last fact of itself speaks against the supposition that the poison of the diphtheria bacillus is a ferment or an enzym. Further examination of this substance showed it was not a ptomaïne or toxine. No crystallizable substance, save kreatinin and cholin, was obtained. Shortly summing up their investigations, the authors seem to have discovered in the diphtheria bacillus a substance belonging to the albumen series of bodies, which has poisonous properties, and causes the phenomena of diphtheria when injected. They propose to give it the name of "toxalbumine." In the living body they consider that the bacteria build up and separate their toxalbumine from the albumen of the tissues. Brieger and Fränkel also examined typhoid, tetanus, and cholera bacteria, and staphylococcus aureus and watery extracts of the internal organs of animals killed by anthrax, in the same way as they had examined the diphtheria bacillus, and found in all of them bodies which, according to their chemical behavior, were albuminoids, were poisonous, and could therefore be aptly called toxalbumines. The road from normal constituents of the body to substances of the most dangerous kind seems a very short one, and our organism itself may be looked upon as the proximate cause of morbid conditions let loose by the life-activity of bacteria.

NOTES AND NEWS.

THE trustees of Johns Hopkins University have decided to reopen the Marine Laboratory of the university in the coming spring. Further announcements will be made later.

— We learn from the London *Journal of Education*, that, according to returns compiled by the Civic Statistical Bureau of the schools of Munich, there were in 1889 in those schools 2,327 children suffering from defective sight; to wit, 996 boys and 1,331 girls. The gradual increase in the figures, which proceeds according to the distribution of the pupils into several classes, is highly significant. Of every 1,000 boys in the first or elementary class, 36 are short-sighted; in the second, 49; in the third, 70; in the fourth, 94; in the fifth, 108; in the sixth, 104; and in the seventh and last, 108. The number of short-sighted boys, therefore, from the first class to the seventh, increases about threefold. In the case of the girls the increase is from 37 to 119.

— Dr. Schmidt-Rimpler, the well-known Göttingen oculist, has been asked by the Cultusminister von Gossler to draw up a list of requirements for diminishing the shortsightedness so prevalent in German schools. Dr. Schmidt-Rimpler, according to the London *Journal of Education*, recommends (1) that teachers must acquire some knowledge of school hygiene; (2) that a medical attendant be attached to the school staff, and periodically inspect not only the school, but individual pupils; (3) that printed instructions be sent to the parents to inform them of the best position of the body for their children, especially with reference to writing, while engaged in the preparation of home-lessons; (4) that afternoon school be abolished, as far as is possible, so that the children may have plenty of exercise in fresh air; (5) that the amount of home-work be diminished, especially with regard to written tasks; (6) that the school course be not allowed to extend over too many years.

— The public lecture course of the New York Academy of Sciences for the season of 1890-91 is as follows: Nov. 24. "The Cliff Dwellings of the Mancos Cañons" (illustrated by projections of original photographs), by Mr. Frederick H. Chapin of Hartford, Conn.; Dec. 15, "Life and Scenes in the Hawaiian Islands" (illustrated), by Dr. H. Carrington Bolton of New York; Jan. 19, 1891, "Science and Miracle," by Professor A. J. Du Bois of Yale University, New Haven; Feb. 16, "Instantaneous Photography as an Aid to Science, History, and Art" (illustrated by novel lantern views), by Professor Wallace Goold Levison of Brooklyn, N.Y.; March 16, "The Orkneys and Shetlands" (illustrated), by Professor Charles Sprague Smith of Columbia College, New York; April 20, "Practical Applications of Electricity" (illustrated experimentally), by Francis B Crocker, E.M., of Columbia College; May 18. "What is a Diatom?" (illustrated,) by Charles F. Cox, M.A., of New York.

—W. T. Harris, United States commissioner of education, Washington, D.C., has issued a circular letter, dated Dec. 10, to presidents of colleges and universities in the United States, in which he says that it is assumed that language instruction in colleges and universities, so far as it relates to living tongues, is based on

the system of "visible speech" invented by Mr. Alexander Melville Bell, and that by its aid the pronunciation of a dialect can be conveyed in writing by one who has learned the sounds, to another person who has never heard the sounds, with reasonable accuracy. The object of this letter is to state that a rare opportunity is now presented to a limited number of higher educational institutions to avail themselves of the direct teaching of Mr. Bell through a lecture in elucidation of visible speech. All teachers of comparative philology understand this system, but perhaps can learn something in regard to the method of teaching it by seeing the method employed by Mr. Bell himself. It may be stated that the inventor of this system does not require any compensation for his lecture, but is willing to engage during the coming season, January to June, 1891, to give a free lecture on the subject named. Applications should be addressed to Mr. Alexander Melville Bell, 1525 Thirty-fifth Street, N.W., Washington, D C. Mr. Bell begs to state that for colleges, etc , near and to the south of the District of Columbia, early dates should be selected, and immediate application made, in order that visits may be serially arranged.

— The *Journal of Education* (London) is authority for the statement that Professors Ludwig, Wislicenus, Bruns, Bohm, Hoffmann, and Ostwald, all of the University of Leipzig, have signed the following declaration: "The undersigned, without as yet deciding what the course of instruction in the high-schools should be, nevertheless feel themselves compelled to declare that the education which our students have received in the Gymnasia, as at present constituted, is but little suited as a basis for the study of natural science and medicine." This has called forth the following counter-declaration, signed by one hundred and twenty-two Leipzig professors: "The undersigned professors and lecturers of the University of Leipzig declare that all educational reforms which do away with, or materially lessen, the study of the Greek language and literature, can only result in a serious injury to our national education. At the same time the undersigned express their conviction that the alterations, which may possibly be necessary in certain particulars, are quite possible with the retention of the classical basis of our Gymnasium education." Among the supporters of this declaration are the "Cultusminister" of Prussia, Bavaria, Saxony, Würtemberg, and Baden.

— Mr. Arthur Winslow, State geologist of Missouri, in his report of the operations of the State Geological Survey during the month of November, says that detailed mapping has been continued in Johnson, Madison, St. François, Washington, and Iron Counties, and about 170 square miles have been covered. In the laboratory analyses have been made of mineral waters collected during September and October, and work on a large number of clay samples has also been in progress. Examinations of clay deposits and building-stones have been made in Henry, Vernon, Bates, and Johnson Counties, and a number of specimens and samples have been collected for exhibition and test. For the purposes of the preliminary report upon the coal-deposits of the State, inspections have been extended into Miller, Morgan, Bates, Vernon, Dade, Cooper, Saline, and Audrain Counties. The field-work allotted to the past season is now very nearly completed, and during the month of December all members of the survey will be withdrawn from continuous field-work until next spring, and the intervening time will be devoted to preparing the results of the past season's work for publication.

— The board of directors of the National Educational Association, at the meeting held in St. Paul, indicated Saratoga Springs, N.Y., as their first choice, and Toronto, Canada, as their second choice, as the place of holding the next meeting of the association. The executive committee was instructed to make personal examination of railway facilities and local guaranties, and was empowered to make final decision as to time and place, and to complete arrangements for the next meeting. Three members of the committee visited Saratoga Springs. The local and State authorities gave guaranties beyond the requirements; but the Trunk Line Association, in whose territory Saratoga Springs is situated, refused to grant the customary reduced rates. The committee then opened negotiations with Toronto. Four members of the committee have visited that city and held consultations with the local and railroad authorities. Satisfactory guaranties have been presented by the local authorities and by the railroads with the exception of the Trunk Line Association. The next meeting of the association will be held at Toronto, Canada, July 14–17, 1891. The council will convene July 10. A cordial invitation, indorsed by the authorities of Ontario, of every province in Canada, and by the authorities of the Dominion, has been before the association for two years. Many of the teachers of Canada have become members of the association. They will meet in Toronto in full force, and will prepare an exhibit giving a complete view of Canadian systems of education.

— A patent has been issued this week to N. D. C. Hodges, editor of *Science*, for an improved method of protecting buildings from lightning. This invention is based on the large electrical capacity of a fine powder scattered in a dielectric. The electrical discharge is received on some body, which is then dissipated in the form of powder, and the potential of the charge is thereby largely reduced. The quantity of material which it is necessary to dissipate in order to furnish protection is not large if the material be placed so as to serve to the best advantage, at the most not exceeding a few cubic inches.

— In connection with the meeting of the National Electric Light Association in Providence, R.I., on Feb. 17, 18, and 19, 1891, it is proposed to hold an exhibition of electrical apparatus and appliances, especially such as are used in the business of furnishing light and power. A suitable hall has been secured opposite the hotel, which will be the association headquarters; and through the courtesy of the Narragansett Electric Lighting Company all the electric current necessary will be provided. There will be no charge for space or current to exhibiters, who must, however, be associate members of the association. The installation and care of exhibits will, of course, be at the expense of exhibiters. As this meeting may be said to virtually mark the close of the first decade of electric lighting commercially, it is suggested, that, as far as possible, efforts be made to show the progress in the art by exhibiting the earlier forms of apparatus and appliances, together with those embodying the latest improvements. The exhibition will open on Tuesday, Feb. 17, and close on Thursday evening, Feb. 19, and will be open day and evening. Exhibits may be installed on the Saturday and Monday previous, and removed on the following Friday. It is expected that this exhibition will prove very attractive to the Providence public, as well as to the members of the association. To exclude the street-gamin element, a nominal admission fee (twenty five cents) will be charged; but it is intended to circulate complimentary invitations freely among the representative business-men of the city, and exhibiters will be supplied with as many complimentary tickets as they may desire to distribute. As space is limited, and will be allotted in the order in which applications are received, it is desirable that all intending exhibiters apply to the chairman of the committee, C. H. Barney, 20 Cortlandt Street, New York, prior to Jan. 15, 1891, at which date all allotments of space will be made.

— The Copley Medal of the Royal Society, London, has been awarded to Professor Simon Newcomb of Johns Hopkins University, and superintendent of the "Nautical Almanac," for his contributions to gravitational astronomy. The medal was first given by the society in 1753, to Dr. Benjamin Franklin. In the following list the names are recorded of those who have received this honor during the last thirty years: 1860, R. W. Bunsen; 1861, L. Agassiz; 1862, T. Graham; 1863, A. Sedgwick; 1864, C. Darwin; 1865, M. Chasles; 1866, J. Plücker; 1867, K. E. von Baer; 1868, C. Wheatstone; 1869, H. V. Regnault; 1870, J. R. Joule; 1871, J. R. Mayer; 1872, F. Wöhler; 1873, H. L. F. Helmholtz; 1874, L. Pasteur; 1875, A. W. Hofmann; 1876, C. Bernard; 1877, J. D. Dana; 1878, J. B. Boussingault; 1879, R. J. E. Clausius; 1880, J. J. Sylvester; 1881, K. A. Würtz; 1882, A. Cayley; 1883, William Thomson; 1884, C. Ludwig; 1885, A. Kekulé; 1886, F. E. Neumann; 1887, J. D. Hooker; 1888, T. H. Huxley; 1889, G. Salmon; 1890, S. Newcomb. The mathematical medalists in previous years have been, Waring (1784), Ivory (1814), Gauss (1838), Sturm (1841), Chasles (1865), Plücker (1866), Sylvester (1880), Cayley (1882), Thomson (1883), Salmon (1889).

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

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CONTENTS:

UNIVERSITY AND SCHOOL EXTENSION.

THE design of the University and School Extension recently started in this city is to supplement the university and the school systems by means of outlines for courses of study, class instruction, courses of lectures, correspondence, examinations, etc. The executive committee of the faculty consists of President Timothy Dwight, president of Yale University; Francis L. Patton, president of Princeton University; Seth Low, president of Columbia College; N. A. Calkins, superintendent of school extension; W. T. Harris, United States commissioner of education; Seth T. Stewart, general secretary. The officers of the board of directors are, president, James W. Alexander (Princeton); vice-presidents, Chauncey M. Depew (Yale), Charles S. Fairchild (Harvard), W. Bayard Cutting (Columbia); treasurer, George Foster Peabody (16 and 18 Broad Street, New York City); secretary, Matthew J. Elgas (121 West 87th Street, New York City).

The purpose is to develop a taste for further education and broader culture among those who, from necessity, have been debarred from some of the advantages of college or academic training, and to provide the skilful guidance of college professors and other experts in the study of the various subjects common to school and to university education The courses of instruction will be marked out by carefully prepared syllabuses, with directions as to what is most essential to the subject.

Individual students can be graded in lines of study and investigation; and plans are provided for securing the interest, sympathy, and mutual help that come through class instruction and lectures. Teachers and others associated in small or large classes may be guided in their studies, or they may enjoy the presence and advice of an approved class instructor in their chosen subject. In this way societies organized for the study of any language or department of history or science can be provided with reliable guidance and competent instruction. The classes will be formed for day or evening, at hours and places to suit the convenience of the class. Individuals or classes may also have the benefit of instruction by correspondence.

Syllabuses have been prepared by the professors named in connection with the following subjects, and others are now in the process of publication: German (four years), Professor H. H. Boyesen, Columbia; French (four years); Latin (four years), Professor Tracy Peck, Yale; Greek (three years), Professor T. D. Seymour, Yale; English literature of the seventeenth, eighteenth, and nineteenth centuries, Professor F. J. Child, Harvard; Shakspeare and Chaucer, George Lyman Kittredge, Harvard; American history to 1789, American history from 1789, European history from 1600 to 1750, European history from 1750, Professor S. M. Macvane, Harvard; law (two years), Professor Theodore Dwight, Columbia; physical geography (first and second years), Professor William Libbey, jun., Princeton; geology, Professor N. S. Shaler, Harvard; physics, Professor C. F. Brackett, Princeton; chemistry (two years), Professor William G. Mixter, Yale; astronomy, Professor C. A. Young, Princeton; elements of zoölogy, Alpheus Hyatt; political science, Professor John W. Burgess, Columbia; descriptive psychology and physiological psychology, Professor George T. Ladd, Yale; philosophy of education. N. A. Calkins; plane and solid geometry, plane trigonometry, and spherical trigonometry, Professor A. W. Phillips, Yale.

The registration fee of one dollar entitles each registered student to one syllabus, one book-list with prices, the privilege of purchasing the books through the general secretary at list or wholesale prices, and an examination-paper in any one of the subjects in which an examination is held. It also entitles members to receive information as to the formation of classes, and to register for correspondence classes and for examination; but the correspondence fee of ten dollars, or the examination fee of two dollars, will be required before said correspondence or examination begins. Additional syllabuses may be had at twenty cents each, or six for a dollar.

Societies guaranteeing minimum charge for course of lessons or lectures will be accommodated as to time, place, and choice of instructor or lecturer. Ladies and gentlemen desiring to become patrons of a special subject of learning may organize auxiliary societies under a prescribed constitution, involving an annual membership fee of ten dollars per share. Any one desiring to promote the work among any class of people may assist in organizing them under constitutions involving membership fees of five dollars per share, or of one dollar per share, covering registration fee, the latter requiring extra charge for work done. A few general courses of lectures will be announced in New York City this year; but other courses will be given if a sufficient number register for the same in any chosen subject. The registration fee of one dollar will hold good until the member in any place shall have had an opportunity to attend class instruction or lectures in some one subject, or to receive correspondence instruction or lectures in a desired subject. Thereafter the fee will be an annual fee.

The registration fee should be sent to the general secretary, or in New York City to Matthew J. Elgas, secretary, 121 West 87th Street. Persons interested in the formation of classes, or lecture courses, or auxiliary societies, will be provided with the necessary forms and information on applying, with stamp enclosed, to Seth T. Stewart, general secretary, P. O. Box 192, Brooklyn, N.Y.

LETTERS TO THE EDITOR.

Dr. Hann's Studies on Cyclones and Anticyclones.

UNDER this heading appeared in *Science*, May 30 of this year, a notice, by Professor W. M. Davis of Harvard College, of a memoir by Dr. Hann of Vienna on "The High-Pressure Area of November, 1889, in Central Europe," etc., which has been recently

published. This notice itself requires a notice here, inasmuch as it aims a blow, not only at all recent advancement in cyclonology, but even at its very foundation in Espy's condensation theory. This notice has been long delayed from a desire to first see, and to reply to, Dr. Hann's memoir, which could not be found either in Washington or Boston. In this memoir, as the reader has been advised, Dr. Hann takes a new position with regard to the origin of cyclones; namely, that they depend upon the same forces, arising from the difference of temperature between the equatorial and polar regions, upon which the general circulation does, and that they are therefore simply subordinate parts of this circulation, and independent of any local causes. Professor Davis seems to have fallen in at first sight, as it were, with this new hypothesis, and says, "Having frequently advocated the sufficiency of the convectional theory of cyclones, I now make haste to place Dr. Hann's observations before the readers of *Science*, that they may see how clearly a revision of opinion is called for."

The great facility with which Professor Davis, apparently, can at once change his views on an intricate and perplexing scientific subject, which has puzzled profound thinkers, and his haste to forsake his former teaching and to rush into print to acknowledge his past errors, and, with the usual zeal of a new convert, to proclaim the newly adopted faith, seems very remarkable; so much so, that a suspicion arises that a little supposed high authority in high position has had more to do in the matter than a profound study of physical and mechanical principles. Dr. Hann's memoir was read before the Vienna Academy on April 17, was printed and received in this country by Professor Davis, and his notice of it appeared in *Science* of May 30: so it is seen how sudden the transition must have been.

So far, we merely have Dr. Hann's annunciation of the new hypothesis, without any attempt to form a theory from it by showing in what way the forces which give rise to the general circulation, and which act in two directions only, — toward the poles above, and the reverse in the lower part of the atmosphere, — can be brought to bear so as to give rise to the subordinate cyclonic disturbances, and to follow them up in their progressive motions so as to keep up the gyrations. A mere hypothesis, if it is a reasonable one, may be very useful as a basis of work or research of any kind, but in itself it proves nothing. If a plausible theory can be built up from the new hypothesis: if it can be shown how, from the general motions of the atmosphere, or the forces upon which they depend, a couple of forces can arise, necessary to give rise to a cyclonic motion, and then how this couple of forces follows after the cyclone to keep it in motion, as the boy with his trundling stick follows after his hoop, and gives it well-directed blows, always in the proper direction; why this couple of forces always tends to give a gyration in one way only in the northern hemisphere, and the contrary in the southern hemisphere; why the air in the cyclone always ascends and never descends; and so on, — very well. We will wait for this to be done. All this has been done in the condensation theory of cyclones, with results so satisfactory as to scarcely leave a doubt as to the truth of the whole theory; and we have a right to claim that as much should be done upon the new hypothesis, before it can be accepted.

Espy had a cast of mind which was not satisfied with vague general assertions, such as that cyclones are caused by the meeting of counter-currents of the air, and that they are continued, and all the powerful mechanical effects are produced, without the expenditure of any energy. And so, in seeking a source of energy, the happy thought occurred to him that this is to be found in the latent heat given out in the condensation of aqueous vapor in the interior of a cyclone, where there is always more or less rainfall. As the air, charged with vapor, is drawn in from all sides below and ascends, the vapor is condensed, and the latent heat given out keeps the ascending air warmer and lighter than the surrounding air. This accounts very satisfactorily for the ascent of air in the interior; and the energy by which the ascent of air and the whole vertical circulation is maintained is laid up in store in the lower part of the atmosphere, through which the cyclone passes, and is not found in the upper poleward-moving currents, as Dr. Hann says, from which there is no imaginable way in which it can be brought down and applied to the cyclone in the lower part of the atmosphere.

The air, being drawn in from all sides below, is pressed toward the right in the northern hemisphere, as is well known, by the deflecting force of the earth's rotation; and so there is a couple of forces, all around, acting in one direction on the one side, and the contrary on the other, which originates and maintains the gyratory movement; but the energy spent is all in the latent heat set free, and the deflecting force simply modifies the directions of motion. This accounts also, not only for the gyratory motion, but also for its being always in the same way in the same hemisphere. This very beautiful and satisfactory theory, so briefly sketched here, Professor Davis would have us give up for the merely vague general hypothesis that all depends upon the general circulation, without its having been shown how any of the motions of the cyclone, as accounted for above, can be accounted for upon this new hypothesis.

But of this theory Professor Davis says, it "is merely a local application of a theory that is universally accepted to account for the general circulation of the atmosphere between equator and poles; but the tests now furnished by high-level observations seem to show that the local application of the theory is incorrect." In the general circulation of the atmosphere the air rises in the equatorial regions where it is warmer and lighter, and sinks down in the polar regions where it is colder and heavier. But, according to Davis, the local application of this principle in the case of cyclones is not correct, but must be reversed; and the air in a cyclone rises in the interior where it is colder and heavier, and sinks down where it is warmer and lighter, and this is shown by the tests of high-level observations referred to. It is proposed, now, to examine some of these tests.

One of these high-level tests is found in the temperature observations made at numerous low and high stations among the Alps on Oct. 1, 1889. These gave a temperature of about 4° C., on the average, lower than that of a three-years' normal, for all the stations ranging in altitude from a few hundred metres up to 3,100 metres. The argument in this case seems to be this: these temperatures are 4° below the three-years' normal; therefore the condensation theory is not a correct theory. In drawing this conclusion, no consideration whatever seems to have been given to the question of what the real requirements of the condensation theory are, and at least two false assumptions have to be made. In the first place, it is assumed that surface temperatures in a cyclone must be above those of the three-years' normal, whereas the conditions of a cyclone have nothing to do with a three-years' normal or any other normal. It is simply required that the temperature of the air in general, over an area of several hundred miles in diameter in the interior of a cyclone, shall be higher than that of the air generally around and outside of this area at the time of the occurrence of a cyclone, so that the heavier air around the cyclone shall force the interior air up, and cause an ascending current. And it is not necessary that even this condition be fulfilled at the earth's surface and at all altitudes, but simply through a certain range of altitude; and this may be, and generally is, up in the cloud regions far above the earth's surface. Say the air below, for a mile or two up, had a lower temperature than the surroundings, but that the necessary cyclone conditions existed above this: thus a vertical circulation and a whirl in the air would take place above, which would diminish the pressure below in the interior, and increase it around about, so that in this way the air below, although having a lower temperature than the surroundings, would be brought into the vertical circulation and cyclonic gyration both by the change in the pressure conditions and by the action of the air above upon it through friction. Of course, in such a case the motions of this lower air would be at the expense of the energy above, and so the whole cyclonic system of motion would not be of a violent character. This seems to have been the character of the cyclone under consideration. There was only a very moderate barometric depression over a large area, the minimum pressure being 752 millimetres, the winds were gentle, and there was some rain and snow. If, therefore, the observed temperatures had even been 4° lower than the surrounding temperatures at the same level at a distance of several hundred

miles in all directions, instead of 4° below the three-years' normal, no conclusive argument could be drawn from it. But it is well known that the temperature departures from the normals are often very great and of long continuance. The observed temperatures, therefore, on Oct. 1, may have been 4° C. below the normal, and yet 5° or more above the surrounding temperatures at a great distance; and unless these surrounding temperatures are observed all around at distances of several hundred miles, and at almost all altitudes, or at least up three or four miles, so that there can be a comparison of the interior and exterior temperatures all around at the same levels, no argument can be deduced against the condensation theory of cyclones. In fact, it is readily seen from this that the theory can neither be proved nor disproved in this way, nor by a comparison of the interior temperatures with normals.

It is well known that surface temperatures, on the average, in cyclones, are generally below the normal temperatures, especially in the summer season. This is due, as Dr. Hann explained several years ago, to the products of condensation falling from high and cold altitudes. In Dr. Hann's memoir it is stated that on the day and evening preceding Oct. 1 rain fell in the valleys, and snow on the mountains. Now, it must be noted here that all the observations in the Alps on Oct. 1, from which the interior temperature of the cyclone, up to an altitude of 3,100 metres, has been estimated, were surface temperatures, and consequently they were considerably lower than they otherwise would have been, from the effect of the recently fallen snow. They cannot, therefore, be assumed to be the same as open-air temperatures, even at a little distance on the same levels, and, much less, can they represent the general average of the great mass of air in the interior of the cyclone, of perhaps five or six hundred miles in diameter and up to a considerable altitude. Since this has been explained by Dr. Hann to be a mere surface effect, why now attempt to deduce an argument from it against the condensation theory?

Another false assumption in the preceding argument is, that cyclones occur in a normal state of the atmosphere; for, unless they do, it is not logical to compare the observed temperatures in a cyclone, in the average of many observations, with the normal, and, if found to be less, to infer that the temperatures in cyclones are less than in the surroundings generally. The normal state of the atmosphere is one of stability, whereas cyclones occur in an unstable state of the atmosphere, when the vertical temperature gradient is abnormally large, and so when the parts of the atmosphere on a level with the upper part of the cyclone has a lower temperature than usual in reference to the temperature of the lower part; or, in other words, the average temperatures of the air at considerable altitudes, taken when the air is in an unstable state, and so when the conditions are favorable for cyclones, must be less than the general average of all times. The observed temperatures, therefore, in a cyclone at high-level stations, may be lower on the average of many observations, and yet higher than the average surrounding temperatures at the times of the cyclones, for these are below the normal on the average at these times. The observed negative temperature departures from the normal on Oct. 1, 1889, at the high stations in the Alps, may have been due to the fact that the air at the high levels at the time, both in and around the cyclone, had a temperature considerably below the normal on account of the abnormal and unstable state of the atmosphere at the time: and so on this account the observed temperatures may have been lower than the normal, and yet above the temperature of the surroundings; and so the necessary conditions of a cyclone would still have been fulfilled. The negative temperature departures on Oct. 1 were mostly at the higher stations.

Another of the high-level tests is the observed high temperature at elevated stations at the times of long-continued high barometric pressures, and especially that of the high-pressure area of November, 1889, over the Alps, which continued fourteen days. It is well known that in such cases there is a body of abnormally heated air at some distance above the earth's surface, of a foehn-like character, arising from the downward current which must necessarily exist in the high-pressure area. When the high pressure occurs over a mountainous region, such as that of the Alps, with high-level stations of observation, such abnormally high temperatures are frequently observed. Because these temperatures are frequently above the normal temperature of the month, or season of the year, and also sometimes found to be higher than the temperatures observed in cyclones at corresponding seasons, it is attempted to base an argument upon this against the condensation theory of cyclones. But what connection there is between the observed premise and the conclusion the writer is entirely unable to see. Whatever may have been the peculiar circumstances under which the long-continued high pressure existed, even if the temperature within had been raised 20° above the normal, he cannot see how this would interfere with the existence of the necessary conditions of a cyclone by the condensation theory, say in America, at the same time; and especially, it could have nothing to do with their existence at other times; and these long-continued high-pressure areas are not of frequent occurrence. These conditions, as is well known, are simply that the vertical temperature gradient at the time of the cyclone shall be greater than usual, so as to induce the unstable state in which the temperature of the air in the ascending current in the interior of the cyclone shall be kept, by the latent heat given out in the condensation of the aqueous vapor, a little above that of the surroundings, and so its specific gravity a little less. There is no reason why such conditions could not exist in America, or even anywhere at a considerable distance, during the time even of the existence of this peculiar state of pressure and temperature conditions over the Alps. It has never been claimed that the conditions of a cyclone exist in these high-pressure areas, and it is well known that the tendency is for cyclones to pass around such areas. Will Professor Davis be so good as to throw some light upon this dark part of the argument, so that there may be a clear understanding of it, and a thorough discussion of it at some other time?

Since by the new hypothesis the energy of cyclones is in the upper poleward-moving current of high latitudes, where the pressure gradients between the equator and the pole are steep, Professor Davis seems to realize the difficulty in applying this energy to the cyclones which originate below the tropics near the equator. He therefore thinks that a little of Espy's "steam-power" may be necessary at first until they get a start. During this time the energy is in the latent heat of the aqueous vapor, by which, set free in condensation, the ascending air is kept warmer and lighter than the surrounding air, and the gyration depends upon the deflecting tendency of the earth's rotation. But being once under way, this is changed, and the ascending air in the cyclone is colder and heavier than the surrounding air. At first it is compared with a train of cars, driven by its own store of energy; but after a time the engine becomes simply a dummy, and the train is driven by an external motor. But this is not strictly a happy comparison; for, instead of the engine becoming a dummy, it becomes a reversed engine. Before the change the ascending air was lighter than the surrounding air, and so the tendency was for it to rise, and for the cyclone to be continued; but after the change, when the ascending air was heavier, the tendency was just the reverse. Nevertheless the cyclone machine, after the reversal of the engine, seems to run on, all the same, and even with increased energy. Davis says the external motor is the general circulation of the winds. But why not say electricity? This would be just as satisfactory. It must be remembered here that the question is not with regard to the progressive motion of the cyclone, for there is no difficulty here, but with regard to the force which causes the heavier air to rise, and which maintains the gyratory motion. The mere assertion that these arise from the general circulation cannot be accepted in a scientific argument. Let it be proved, from true physical and mechanical principles, that there is a force arising from the general circulation which acts on all sides of the cyclone so as to force the heavier air up, and also acts as a couple in keeping up the gyration, or at least make it appear that this is probable; for unfortunately there are many things in science which cannot be absolutely proved, but only be made to appear reasonable and probable.

From what has been stated, it seems, that, of two rival theories, the one is applicable to the cyclone in the first part of its course, and the other in the latter part. But how is it with regard to tornadoes? Does the powerful ascent of air in these arise

from the unstable state in which the air in ascending becomes lighter than the surrounding air as it rises, or is it heavier in this case also, and has to be pushed up, as in the case of cyclones, by some external centripetal force on all sides at the base, originating in the steep gradients of the upper part of the atmosphere in high latitudes? for it must be remembered that by the new theory cyclones originate here. If the former, as is admitted in the case of tropical cyclones, then it is evident that the unstable state of the air can take place; and, if so, why can it not exist in the case of cyclones, in America at least, notwithstanding that the temperature of the air over the Alps, under some peculiar circumstances, sometimes becomes greater than the normal temperature, and than the mere surface temperatures on the Alps in a cyclone immediately after a recent fall of snow? As Professor Davis is the first one in America to adopt the new theory, if it can be so called, he must be regarded as its exponent here, and so feel bound to answer all pertinent questions and to give all necessary explanations; for it is to be presumed, that, during the two or three weeks of the transition period, he thoroughly studied it in all its bearings and applications. WM. FERREL.

Martinsburg, W.Va., Dec. 12.

BOOK-REVIEWS.

Electricity in Daily Life. New York, Scribner. 8°. $3.

FROM whatever point of view this book may be regarded, the effect cannot fail to be satisfactory. The expert electrician will find in it a succinct yet comprehensive survey of the whole field of electrical progress, from the earliest experiments down to the latest applications, with invaluable data made readily available by a copious index; the student will find it a guide to the particular branch of the science he may be specially interested in; and the general reader will find in it all that he may desire in the way of general information upon a subject comparatively new, fascinating in itself, and the results of which he is forced into contact with at almost every turn.

The volume is the joint production of Cyrus F. Brackett, Franklin L. Pope, Joseph Wetzler, Professor Morton, Charles L. Buckingham, Herbert L. Webb, W. S. Hughes, John Millis, A. E. Kennelly, and M. Allen Starr, M.D., each an authority on the special branch of which he treats. The publishers have done their part handsomely, the illustrations and typography being excellent, and the general make-up and finish of the volume setting off to the best advantage the work of its several writers. Even in the embellishment of the cover the artists have drawn their inspiration from the text, the ornamentation being worked up from fragments of telegraphic messages as recorded by the Morse instrument and the siphon recorder, and as prepared on a perforated ribbon for transmission by the Wheatstone instrument, together with artistic groupings of incandescent lamps and cables in outline and section.

In the opening chapter Mr. C. F. Brackett, professor of physics in Princeton College, briefly surveys the whole field of electrical science, tracing its history, explaining its technicalities, and making clear the principles involved in the use of conductors and insulators, and in the construction and operation of galvanometers, electro-magnets, dynamos and motors, transformers, and storage-batteries. In the second chapter Mr. Pope, past president of the American Institute of Electrical Engineers, treats of the electric motor and its applications, giving some account of every thing of importance in that department, beginning with Faraday's first motor, touching on the experiments of Ampère and Arago, Professors Henry and Jacobi, Dr. Page, and others, and going into greater detail on the evolution of the dynamos and motors of to-day. Joseph Wetzler of the *Electrical Engineer* makes an interesting chapter on the electric railway, explaining the three methods of applying the current to the railway motor,—the overhead-wire system, the underground-conduit system, and the storage-battery system; besides which he recounts the many advantages claimed for electrical over other roads, shows the comparative cost of construction, gives some electric-railway statistics for the United States, and points out the possibilities of the future in that direction. Electricity in lighting is ably treated by President Morton of the Stevens Institute, who touches all the salient points of that application of electrical energy, from Sir Humphry Davy's first electric light in 1808, down to the present time, when, as he states on p. 123, the daily output of incandescent electric lamps in this country alone is fifteen thousand, or at the rate of four million and a half lamps a year.

In the succeeding chapters the electric telegraph is treated of by Charles L. Buckingham of the Western Union Telegraph Company; the making and laying of submarine and other cables, by Herbert Laws Webb of the Metropolitan Telephone Company; electricity in naval and land warfare, by Lieut. Hughes of the navy, and Lieut. Millis of the army, respectively; electricity in the household, by Electrician Kennelly of Edison's laboratory; and electricity in relation to the human body, by M. Allen Starr, M.D., professor of nervous diseases in the College of Physicians and Surgeons of New York.

AMONG THE PUBLISHERS.

THE Christmas number of the American edition of the *Illustrated London News* contains three well-executed colored plates which have become a feature of a few of the largest weekly illustrated papers at the holiday season.

— Messrs. E. & F. N. Spon announce the following new books: "Electric Bell Construction: a Treatise on the Construction of Electric Bells, Indicators, and Similar Apparatus," by F. C. Allsop; "The Steam-Engine considered as a Thermo-dynamic Engine" (second edition, revised and enlarged), by J. H. Cotterill; "Smokeless Powder and its Influence on Gun Construction," by J. A. Longridge; "Modern Cotton-Spinning Machinery, its Principles and Construction," by J. Nasmith; and *The Journal of the Iron and Steel Institute*, No. 1, 1890.

—One of the most remarkable lists of famous contributors ever brought together in a single number of a magazine will be presented in the January issue of *The Ladies' Home Journal* of Philadelphia. The authors in that number will include Henry M. Stanley, Dr. Oliver Wendell Holmes, Ex-President Hayes, Hon. John Wanamaker, Joseph Jefferson, Hon. Hannibal Hamlin, Madame Albani, James Whitcomb Riley, Gen. Lew Wallace, George W. Childs, Dr. T. De Witt Talmage, Mrs. A. D. T. Whitney, Robert J. Burdette, Edward Bellamy, Will Carleton, Charles A. Dana, Sarah Orne Jewett, George W. Cable, Julian Hawthorne, Mrs. Lyman Abbott, Mrs. Margaret Bottome, and nearly twenty others.

—Messrs. Ginn & Co. announce to be published in February "Mechanism and Personality," by Francis A. Shoup, D.D., professor of analytical physics, University of the South. This book is an outline of philosophy in the light of the latest scientific research. It deals candidly and simply with the burning questions of the day, the object being to help the general reader and students of philosophy find their way to something like definite standing ground among the uncertainties of science and metaphysics. It begins with physiological psychology, treats of the development of the several modes of personality, passes on into metaphysics, and ends in ethics, following, in a general way, the thought of Lotze. It is strictly in line with the remark of Professor Huxley, that the reconciliation of physics and metaphysics lies in the acknowledgment of faults upon both sides, in the confession by physics that all the phenomena of nature are, in their ultimate analysis, known to us only as facts of consciousness, in the admission by metaphysics that the facts of consciousness are practically interpretable only by the methods and the formulæ of physics.

— The late Professor Austin Phelps had just previous to his death completed preparations for a new volume somewhat similar in character to his "My Study" and "My Portfolio." It is entitled "My Note Book," and is to be issued immediately by the Scribners. It contains a number of the author's briefer essays, with some detached thoughts, somewhat of the nature of table-talk. Professor A. L. Perry of Williams College, the well-known author of works on political economy, has just completed a new work entitled "Principles of Political Economy," which will also be

issued at an early date by the Scribners. Col. Church's "Life of Ericsson," issued by the same firm, went into a second edition almost immediately upon publication.

— Among the contents of the *New England Magazine* for December we note, "Emerson and his Friends in Concord," by Frank B. Sanborn; "What shall we do with the Millionnaires?" by Charles F. Dole; "Quebec," by Samuel M. Baylis; "Anti-Slavery Boston," by Archibald H. Grimké; "A Day in the Yosemite with a Kodak," by Samuel Douglass Dodge; "Making Man-o'-war's-men," by W. L. Luce; "Harvard's Better Self," by William Reed Bigelow; "On the Rappahannock," by Charles H. Tiffany; and "King Philip's War," by Caroline Christine Stecker.

— The "Papers of the American Historical Association" for October, just issued by G. P. Putnam's Sons, deal largely with the subject of historical documents and the importance of collecting and preserving them. The opening paper, by John O. Sumner, is on "Materials for the History of the Government of the Southern Confederacy," and gives an account of the difficulties the author met with in searching for such materials. Professor William P. Trent follows in a similar strain, complaining of the indifference shown by most Southerners to their local history. Both writers strongly insist on the importance of collecting the materials for Southern history before it is too late. Mr. William Henry Smith has a paper on "The Pelham Papers," in which he points out their importance for the history of New York in 1755–56. These various essays, together with some shorter ones that this number contains, show that the association is alive to the importance of collecting our historical records, and we trust that it will be successful in doing so. A circular letter from the association to the State historical societies asks for their co-operation in historical work, which will doubtless be gladly given. Besides the papers mentioned, the pamphlet before us contains several others on various themes, the longest and most elaborate being by Mr. William A. Dunning, on "The Impeachment of President Johnson," in which that celebrated case is treated with true historical impartiality. The remaining papers deal with the early history of Kentucky, the economic history of New England, the trial of John Brown, and other topics in American history; but none of them call for any special remark.

— The announcement is made that a new edition of "The Life of Our Lord," by Rev. S. J. Andrews, D.D., largely re-written and brought down to date in every respect, is now in press for early publication. It will be printed from new plates, and will contain a number of maps.

— On or before Jan. 1, 1891, will appear an illustrated magazine entitled the *Bacteriological World*, which will have for mission the general dissemination of knowledge on the subject of bacteriology in general, and pathological micology in particular. The first number will contain the following: frontispiece, Pasteur's and Koch's pictures; "Study of Bacteriology" (preface, introduction, etc.); "Generalities on Germs, Spontaneous Generation;" "Actinomycosis in Man and Beasts (Big Jaw of Cattle);" "Foreign and Home Investigations;" "Bacterial Complication of Wounds (Ogston, Rosenbach, Cornil, Babès, etc.);" "Immunity," by Dr. Bouchard, Paris, France; "Hydrophobia," by Dr. Paul Gibier, Pasteur's Institute, New York City; "True and Spurious Bovine Vaccination and Complications," by Paul Evans, Pathological Laboratory Missouri Agricultural Experiment Station; "Clinical Notes;" editorial; "Koch's Treatment of Tuberculosis;" and "Notes from Laboratories" (Pasteur's laboratory and others). All communications and articles, except those relating to advertisement and subscription, should be addressed to the editor, Paul Paquin, Columbia, Mo., U.S.A. All matters pertaining to advertisement and subscription should be addressed to The Bacteriological World Publishing Company, Columbia, Mo., U.S.A., or Dr. T. J. Turner, Mexico, Mo., U.S.A.

Publications received at Editor's Office, Dec. 8–13.

ADLER, C. Report on the Section of Oriental Antiquities in the U. S. National Museum, 1888. Washington. Government. 12 p. 8°.

BERTENSHAW, T. H. Longmans' French Course. London and New York, Longmans, Green, & Co. 208 p. 12°. 60 cents.

BIRD, C. Elementary Geology. London and New York, Longmans, Green, & Co. 248 p. 12°. 80 cents.

DAWSON, G. M. On the Later Physiographical Geology of the Rocky Mountain Region in Canada, with Special Reference to Changes in Elevation and the History of the Glacial Period. Ottawa, Roy. Soc. Can. 74 p. 4°.

GILL, T. Osteological Characteristics of the Family Amphipnoidæ. Washington, Government. 4 p. 8°.

GOODE, G. B. Report upon the Condition and Progress of the U. S. National Museum during the Year ending June 30, 1888. Washington, Government. 84 p. 8°.

HIPPISLEY, A. E. A Catalogue of the Hippisley Collection of Chinese Porcelains, with a Sketch of the History of Ceramic Art in China. Washington, Government. 105 p. 8°.

HJELT, E. Principles of General Organic Chemistry. Tr. by J. B. Tingle. London and New York. 220 p. 12°. $1.75.

HOUGH, W. Fire-making Apparatus in the United States National Museum. Washington, Government. 57 p. 8°.

JAGO, W. Inorganic Chemistry. London and New York, Longmans, Green, & Co. 458 p. 12°. $1.50.

LUCAS, F. A. The Expedition to the Funk Island, with Observations upon the History and Anatomy of the Great Auk. Washington, Government. 37 p. 8°.

MORRIS, I. H. Practical Plane and Solid Geometry, including Graphic Arithmetic. London and New York, Longmans, Green, & Co. 260 p. 12°. 80 cents.

SEAWELL, Molly Elliot. Little Jarvis. New York, Appleton. 64 p. 12°. $1.

VERÖFFENTLICHUNGEN aus dem Königlichen Museum für Völkerkunde. Band I. Heft 4. Berlin, W. Spemann. 72 p. f°.

— *Scribner* will begin an Australian edition with the January number, and a group of articles on that country will appear during the coming year. Josiah Royce of Harvard writes his "Impressions of Australia" in the January issue, and court-tennis, the oldest game of ball that we have, is described by Dr. James Dwight (ex-champion doubles at lawn-tennis). There are very few courts in this country, those at Boston, Newport, and New York being the chief.

— Henry M. Stanley, in his article on "African Pygmies," to appear in the January *Scribner*, says, "For the benefit of such of your readers as take an interest in pygmy humanity, I have taken the trouble to write this article, that they may have a little more considerateness for the undersized creatures inhabiting the Great Forest of Equatorial Africa. They must relieve their minds of the Darwinian theory, avoid coupling man with the ape, and banish all thoughts of the fictitious small-brained progenitor supposed to be existing somewhere on land unsubmerged since the eocene period. . . . Intellectually, the pygmies of the African forest are the equals of about fifty per cent of the modern inhabitants of any great American city of to-day; and yet there has been no change, or progress of any kind, among the pygmies of the forest since the time of Herodotus.

— A new departure has just been made in periodical literature in the form of a quarterly entitled *The Critical Review of Theological and Philosophical Literature*. It is edited by Professor S. D. F. Salmond of Edinburgh, and contains able reviews of all the notable new books in the fields indicated by the title, giving a chronicle of all publications in these departments, and noticing the more important articles in magazines and journals. The reviews will be the work of eminent writers, and will be signed. The quarterly is published by Messrs. T. & T. Clark of Edinburgh, and is controlled in this country by Messrs. Scribner & Welford. The first number, now ready, contains articles by Principal Rainy, Professor A. B. Davidson, Canon Driver, Professor A. B. Bruce, Professor Marcus Dods, Professor W. G. Blaikie, and other well-known authors.

— *The Political Science Quarterly* for December opens with a study of Henry C. Carey and his social system, by Professor C. H. Levermore. Brander Matthews contributes an article on "The Evolution of Copyright;" Professor Charles Gide of Montpellier, France, discusses the present condition of the study of political economy in France; Professor E. R. A. Seligman concludes his series of articles on "The Taxation of Corporations;" and Professor A. B. Hart gives a sketch of Herman von Holst, both in his private life and his literary career. In addition to these leading articles, the number contains reviews of more than twenty recent publications, with the regular semi-annual "Record of Political Events."

—"Harper's Sixth Reader," which has just been published by the American Book Company, completes the well-known series of school-readers edited by James Baldwin, Ph.D., and heretofore published by Harper & Brothers. The volume is made up wholly of selections from the works of British authors, prose and verse; so that, in schools where an early acquaintance with British writers is thought desirable, its study may be taken up at once upon the completion of the "Fourth Reader," its reading-lessons being of nearly the same grade as the "Fifth Reader" of the same series. Otherwise it may be used alternately with the latter volume, or as a sequel to it. The exercises are well selected and carefully graded, the lessons being so arranged that those requiring deeper thought and greater reading ability follow those which are easier. Among the selections are some of the acknowledged classics of the language, as might naturally be expected in a compilation of the kind. Notes, biographical and otherwise, at the end of the volume, will be found helpful and suggestive to both teacher and pupil

CALENDAR OF SOCIETIES.

Biological Society, Washington.

Dec. 13.—William Palmer, The Occurrence of an Asiatic Cuckoo on the Pribylov Islands; C. V. Riley, New Notes on the Genus Phylloxera; F. W. True, The Teeth of the Muskrat; F. A. Lucas, The Wing of Metopidius.

Boston Society of Natural History.

Dec. 17.—A. E. Dolbear. The Physics of Crystalline and Cellular Structure; T. T. Bouvé, Kame Ridges and Hillocks of Hingham.

Wants.

Any person seeking a position for which he is qualified by his scientific attainments, or any person seeking some one to fill a position of this character, be it that of a teacher of science, chemist, draughtsman, or what not, may have the 'Want' inserted under this head FREE OF COST, *if he satisfies the publisher of the suitable character of his application. Any person seeking information on any scientific question, the address of any scientific man, or who can in any way use this column for a purpose consonant with the nature of the paper, is cordially invited to do so.*

WANTED.—A young man wishes a position as instructor in the sciences in some school or college. Chemistry a specialty. Would like to hear of some position with a private or manufacturing chemist, in which his knowledge of chemistry would help him. Address E. E. TOWNE, B.A., 272 Worthington St., Springfield, Mass.

WANTED.—An Exploring Expedition, backed by $15,000, will be sent into Alaska and the British Northwest Territory the coming year, to be gone one or two seasons. A scientist or two will more than likely be taken along. Applications from such will be gladly received and carefully considered. To assist in making these applications the commander would say that he considers a full practical knowledge of mineralogy and geology necessary, and if the applicant can add the duties of botanist, ethnologist, or any other of the sciences, and photography, sketching, medicine and surgery, or other useful arts for exploring, it will add to the chances of being selected. Applicants must be physically perfect, and ought to be about medium age. One of these scientists will be the second in command of the party. Any credentials forwarded for consideration will be returned, if requested, after consideration. Address "ALASKA," care of *Science*.

WANTED.—There being a considerable annual income for the purchase of books for the Museum Reference Library of Iowa College, it is desirable to have at hand any and all circulars, specimen sheets, catalogues, etc., of all works on Natural History in general, both foreign and domestic. Circulars of museum supplies, apparatus, etc., etc., desired also. State terms. Address ERWIN H. BARBOUR, Box 1333, Grinnell, Iowa.

WANTED.—A situation as Analytical Chemist is desired by the assistant of the late noted scientist, Dr. Cook, during his 15 years survey of the State of New Jersey. Highest testimonials furnished. Address Prof. EDWIN H. BOGARDUS, New Brunswick, P, O. Box 224, care Prof. F. C. Van Dyck.

COULD some one inform me what the ingredients and origin of asphalt as used for street-paving and gathered at Trinidad are? Also how gathered and shipped by natives, and mode of refining by the Warren-Scharf Co. of New York and the Barber Co. of Washington? G. KNIPER, 28 Gunn Block, Grand Rapids, Mich.

Exchanges.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 47 Lafayette Place, New York.]

I wish to exchange Eastern *Lepidoptera* for those that I do not have, particularly those found in the South. Jos. F. Crandall, Honesdale, Wayne Co., Pa.

To exchange, 1890 Seeger and Guernsey Cyclopedia, containing a complete list of the manufactures and products of the U. S., and address of first hands, cost $6. David R. Lewis, Saybrook, Ill.

For exchange—Nice specimens of Unios alatus, trigonus, parvus, occidens, anadontoides gibbosus, rectus, verucosus, gracilis coccineus, ventricasus, multiplicatus and plicatus cornutus. Margaritana confrogosa, complanata, rugosa. Anadonta edentula, decora, corpulenta, and about 300 of the beautiful Ana. suborbiculata. Wanted: Unios from all parts of the world, and sea-shells. Address Dr. W. S. Strode, Bernadotte, Ill.

BOOKS: How to Exchange them for others. Send a postal to the SCIENCE exchange column (insertion free), stating briefly what you want to exchange. SCIENCE, 47 Lafayette Place New York.